Diet of two species of bluetongue skink, *Tiliqua multifasciata* and *Tiliqua occipitalis* (Squamata: Scincidae)

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ABSTRACT

Diets of *Tiliqua multifasciata* and *Tiliqua occipitalis* were studied by examination of stomach contents of 14 and 16 preserved individuals in the collection of the Western Australian Museum. Both species are active foraging omnivores, feeding mostly on diurnally available food. Most stomachs contained plant material, with lower frequencies of arthropods. Fruits and seeds were the predominant parts of plants consumed. The dominant arthropods eaten were insect larvae and beetles. Occasional vertebrate items found in stomachs were mostly sourced as carrion. No significant differences were detected in the diet of the two species. Pronounced differences in the head shape and tooth shape of the two species cannot be explained by differing dietary specialisation.

Key words: Australia; lizard; Scincidae; *Tiliqua*; diet; morphology

Introduction

The large bluetongue skinks of the genus *Tiliqua* are among the most familiar components of the Australian lizard fauna, remaining common in many urban environments (Brereton 1991; Bush *et al*. 1995; Wilson and Czechura 1995; Bennett 1997; Koenig *et al*. 2001). Their large size and ease of handling has made them popular in the pet trade, and as subjects for experimental studies. Despite this, the ecology of several species remains poorly known.

In particular, the natural history of two semi-arid to arid zone species, the Centralian Bluetongue *Tiliqua multifasciata* and the Western Bluetongue *Tiliqua occipitalis*, is almost unknown, although both have distributions that longitudinally and latitudinally cover half or more of the continent. These two species form a distinct clade within *Tiliqua*, sharing several unique synapomorphies (Shea 1992) and, until 1971, being regarded as only subspecifically distinct (Pianka 1971; Shea and Peterson 1981). However, they differ significantly in aspects of their trophic apparatus, with *T. multifasciata* having a proportionally much broader and deeper head than *T. occipitalis* (Table 1), and larger blunter molariform teeth (Shea and Hutchinson 1992). The difference in head shape is partly due to a relatively shorter snout (potentially affecting gape) and longer temporal region (potentially reflecting area for muscles of mastication) for *Tiliqua multifasciata* than for *T. occipitalis* (Table 1).

Further, the two species differ in size. *Tiliqua multifasciata* is a much smaller species than *T. occipitalis* (Table 1), although both are among the largest 1% of species in the family Scincidae (Greer 2001).

In general, large lizards tend to have different diets to small species, with herbivory being a common correlate of large body size (Pough 1973; King 1996), and hence both species could be expected to show some trend to herbivory, as has been seen in other *Tiliqua* species (e.g., Dubas and Bull 1991). The molariform dentition present in bluetongue lizards has been variously interpreted as an adaptation for durophagy or omnivory (Estes and Williams 1984). However, the profound differences in trophic morphology suggest that there may be also be differences between *T. multifasciata* and *T. occipitalis* in prey handling and diet.

Table 1. Differences in body size and head shape between *Tiliqua multifasciata* and *Tiliqua occipitalis* (data from Shea, 1992).

	Tiliqua multifasciata		*Tiliqua occipitalis*	
	Range	Mean	Range	Mean
Mature female snout-vent length	203-289mm	233.6mm	245-307mm	272.7mm
Mature male snout-vent length	201-257mm	227.3mm	231-320mm	265.3mm
Head width/head length	84.5-118.4%	108.1%	76.8-102.5%	90.0%
Head depth/head length	54.1-82.1%	68.5%	50.1-68.4%	58.3%
Eye-naris interval/head length	23.8-33.3%	27.8%	25.1-34.8%	30.0%
Eye-ear interval/head length	41.1-57.2%	50.6%	38.8-50.6%	46.0%

The diets of both species are largely known from serendipitous observations, with the only quantitative analysis of more than three individuals being a numerical tabulation of relative frequency of broad categories of plant, arthropod and vertebrate material in stomachs, compiled as part of a study of gastrointestinal parasites (Jones 1992). This contrasts markedly with the most thoroughly studied species, *Tiliqua rugosa*, for which detailed dietary analyses are available for several populations (Bamford 1980; Brown 1983, 1991; Dubas 1987; Yeatman 1989; Henle 1989, 1990; MacMillen *et al*. 1989; Shea 1989; Dubas and Bull 1991; Jones 1992).

The present paper attempts to partially redress this imbalance, and to test whether the differences in head shape and dentition of the two species are paralleled by dietary differences.

Methods

Preserved lizards in the collection of the Western Australian Museum were dissected by a median or paramedian longitudinal incision. The stomach was longitudinally incised, and gastric contents removed and stored in 70% alcohol. Gastric contents were examined in a petri dish of 70% alcohol, and teased apart under a dissecting microscope. Because most food items were moderately to highly comminuted, no attempt was made to estimate relative volume, although estimates of length (and sometimes width) were made for some more complete food items (see Appendix 1). For analyses, minimum numbers of animal items were estimated from numbers of body segments, heads and limbs. In tabulating insect prey items, larvae were treated as a separate category to adults, as the differing body form and behaviour of larvae and adults is likely to engender different methods of prey location and consumption. Adult prey were identified to at least order when possible.

Stomach contents were examined for 14 *Tiliqua multifasciata* (13 from Kimberley Division, Western Australia; one from North-West Division, Western Australia) and 16 *Tiliqua occipitalis* (13 from South-West Division, Western Australia; one from adjacent parts of North-West Division; one from South Australia; one from Northern Territory) (see Storr 1967, for boundaries of Western Australian divisions). Two additional lizards examined with chunks of meat in the stomach appeared to have been fed in captivity, and these data are not included in this analysis.

Results

In both species, the dominant food types were plants and arthropods (Tables 2-3, Appendix 1).

Because of the comminuted nature of much plant vegetative material, it was not possible to fully quantify the proportion of plant material in the diet. However, in some instances, the plant material present appeared to be accidentally ingested with other food items (e.g., a few wisps of grass in a stomach with animal remains) or secondarily ingested as gut contents of insect prey (e.g., one *T. multifasciata* stomach with large amounts of sliced plant stem of even length, as produced by insect feeding, together with two medium-sized, moderately digested grasshoppers). The summaries in Tables 2-3include all instances of plant material in lizard stomachs, as it is apparent from the frequent presence of large numbers of seeds or fruits that both species do directly consume plant material, and hence it must be assumed that they are able to obtain some nutrients from plant material, whether deliberately or accidentally consumed. In the Appendix, which provides more detailed descriptions of stomach contents, the likely accidentally or secondarily ingested materials are identified.

When plants were consumed, the material was mostly seeds and fruits rather than vegetative material, and often large numbers of seeds/fruits were consumed. For example, one *T. occipitalis* had consumed at least 226 small berries (Appendix 1).

Among arthropod prey material, beetles (Coleoptera), grasshoppers and crickets (Orthoptera) and insect larvae of various types predominated in both species (Table 2). Most of the insect larvae appeared to be lepidopteran, and several were large caterpillars with irritant hairs. When they were present, multiple larvae were generally present in a stomach (mean of 7 larvae per occurrence for *T. multifasciata*; 4.7 per occurrence for *T. occipitalis*), while other insects were generally present at rates of one or two per stomach. While most insect prey items were of moderate size, 15 mm or more in length, a few were small (e.g., small hymenopteran pupae, small beetles), indicating that lizards were not restricted to large prey.

In contrast to the high frequency of insect prey, arachnid and myriapod prey were few. Similarly, molluscs were only found in *Tiliqua occipitalis*, and in low numbers.

Although several vertebrate prey items were recorded (Table 2), these were all fragmentary, and most (e.g., pieces of bone, small numbers of loose feathers, a dried small lizard foot; Appendix) were clearly ingested as incomplete prey items, presumably carrion. Two *T. multifasciata* stomachs contained shed skin of the same species, and were presumably eating their own sloughed skin.

The dietary range and relative proportions of major food items were similar for both species (Tables 2-3). The frequencies of stomachs containing arthropods, vertebrates and plants did not differ between the two species (Fisher's exact test, p = 0.417, 0.399, 1.000 respectively), nor was there a difference between the species in the number of arthropods per stomach (Mann-Whitney U test statistic 74.5, n = 14, 16, p = 0.115).

Discussion

Although there are few previous specific dietary data for either species, the range of dietary items recorded in this study is similar to that previously noted. For *Tiliqua multifasciata*, Loveridge (1934, 1938) reported one lizard vomiting a mixture of seeds, predominantly small split white ones, while another had several species of ants in the stomach. Stammer (1976) reported that the species had been observed eating cattle dung, while Baker *et al*. (1992) reported that the species fed on parakeelya (*Calandrinia* sp., Portulacaceae). These observations are for localities outside the range of those specimens examined in this study, and do not provide any indication of geographic

Table 2. Dietary items from stomach contents of *Tiliqua multifasciata* and *Tiliqua occipitalis.* "No. of individuals" is the number of total prey items of that category (not given for plants) while "No. of stomachs" is the number of lizards containing that prey item. Figures in parentheses in the latter columns are relative frequencies.

	Tiliqua multifasciata		*Tiliqua occipitalis*	
	No. of individuals	No. of stomachs (total n = 14)	No. of individuals	No of stomachs (total n = 16)
Molluca				
Gastropoda			2	1 (0.06)
Arachnida				
Araneida			4	3 (0.19)
Scorpionida			1	1 (0.06)
Myriapoda				
Chilopoda	1	1 (0.07)	1	1 (0.06)
Diplopoda			1	1 (0.06)
Insecta				
Blattodea			3	3 (0.19)
Coleoptera	11	7 (0.50)	24	11 (0.69)
Hymenoptera	3	2 (0.14)	1	1 (0.06)
Orthoptera	6	4 (0.29)	4	4 (0.25)
Larvae	28	4 (0.29)	33	7 (0.44)
egg cases			2	1 (0.06)
unidentified			1	1 (0.06)
Vertebrata				
Squamata				
Tiliqua skin	-	2 (0.14)		
Rankinia adelaidensis			1	1 (0.06)
Aves	2	2 (0.14)	1	1 (0.06)
Mammalia			3	3 (0.19)
Fungi	1	1 (0.07)	6	1 (0.06)
Plants				
Seeds/Fruits	-	9 (0.64)	-	5 (0.31)
Flowers			-	2 (0.13)
Stems/Leaves	-	4 (0.29)	-	5 (0.31)
Herbivore dung			-	1 (0.06)

Table 3. Relative frequencies of major food types in diet of *Tiliqua multifasciata* and *Tiliqua occipitalis.* "No. of individuals" is the number of total prey items of that category (not given for plants) while "No. of stomachs" is the number of lizards containing that prey item. Figures in parentheses in the latter columns are relative frequencies.

	Tiliqua multifasciata		*Tiliqua occipitalis*	
	No. of individuals	No. of stomachs (total n = 14)	No. of individuals	No. of stomachs (total n = 16)
Arthropoda	49	9 (0.64)	70	13 (0.81)
Vertebrata	2	2 (0.14)	4	5 (0.31)
Plant (incl. fungi)	-	12 (0.86)	-	11 (0.69)

variation in diet. Using Western Australian material, including specimens from the Kimberley Division, Jones (1992) reported plant, arthropod and vertebrate material and bird egg in the stomach of 23 *T. multifasciata*, while Pianka (1986), with a sample size of three from the Eastern Division of Western Australia, reported the diet to be 75% plant material, 8% Coleoptera and 5% Orthoptera volumetrically, with smaller amounts (none more than 4%) of Chilopoda, Hymenoptera (all ants), Mantodea, Isoptera, Hemiptera/Homoptera and insect larvae. The present study has also recorded seeds, herbivore dung, and invertebrate and vertebrate material in the diet, although no ants were found among the material examined (the Hymenoptera recorded were pupal wasps and bees).

For *T. occipitalis*, specific dietary data are available for three individuals from south-west Western Australia. Lepidopteran and coleopteran remains were found in one lizard (Chapman and Dell 1979), another contained scarabaeid and curculionid beetles, orthopterans, centipedes, old rabbit bones, fungi and plant remains (Dell and Chapman 1979), and a third had many seeds and flowers of heaths (*Astroloma/ Brachyloma*), together with a cockroach, a grasshopper and a scarabaeid beetle (Dell and Chapman 1977). Jones (1992) reported plant, arthropod, mollusc and vertebrate remains in 22 southern Western Australian specimens. The dietary range in the present study is similar.

The relative frequencies of major types of food for the two species are similar to those found by Jones (1992). For *T. multifasciata*, using the categories plant, arthropod and vertebrate, Jones (1992) reported 16/23 (70%) of those individuals with food items in the stomach to contain arthropods, 13/23 (57%) with plant matter and 1/23 (4%) with vertebrate material, while for the present study (Table 2), the figures are 64%, 71% (excluding plant material that may have been accidentally ingested while swallowing animal food, or secondarily released from insect prey gut contents) and 14% (excluding shed skin). Similarly, for *T. occipitalis*, the frequency of arthropod prey reported by Jones (1992) was 20/22 (91%), plant material 13/22 (59%) and vertebrates 5/22 (23%), while in the present study, the frequencies were 81%, 69% and 31% respectively. The concordance between the two data sets suggests that the relative frequencies reflect the normal pattern of food intake.

The pooling of material from several localities and across years, and the lack of simultaneous studies of availability of food items precludes any analysis of dietary selectivity by either species. Further, as there were no data from sites where the two species are sympatric (e.g., Shea and Peterson 1981; Fyfe 1985), and the majority of data were from the Kimberley for *T. multifasciata* and south-west Western Australia for *T. occipitalis*, two regions with very different biota, it is possible that differences in stomach contents reflect differences in prey availability and not different selection of prey types. However, keeping these caveats in mind, both species appear to be omnivorous, with little indication of any stenophagy. Both have a diet dominated by food items that are either diurnally active or able to be easily located and consumed by day, while prey that are largely nocturnally active and inaccessible by day are rarely eaten. This agrees with the limited data on activity pattern for both species. *Tiliqua occipitalis* is diurnally active (Bush *et al*. 1995; pers. obs.), while *T. multifasciata* varies its activity pattern seasonally, being diurnal in spring and autumn and more crepuscular or even nocturnal in mid-summer (Christian 1977; Hauschild 2004). Both species appear to eat large numbers of slowly moving or non-motile food, and hence can be considered active foragers rather than ambush predators.

These data are similar to those for other *Tiliqua* species, given constraints imposed by availability of different food types. In Sydney suburbs, *Tiliqua scincoides* has been recorded to eat mainly gastropods, arthropods (mostly insects, with Coleoptera most common), plants and anthropogenic food items (Koenig *et al*. 2001) while those in nearby reserves have been recorded as eating insects (lepidopteran larvae, Coleoptera, Blattodea in descending frequency), millipedes, plants (especially fruits) and carrion (Rose 1974; Webb 1983). Stomach contents of *Tiliqua nigrolutea* have been predominantly insects (especially Coleoptera, Homoptera and lepidopteran larvae), and fungi, but also other arthropods, molluscs, small vertebrates (including carrion and mammalian carnivore faeces) and plants (Green and McGarvie 1971; Webb and Simpson 1985; Webb 1987). Even the small species *Tiliqua adelaidensis*, which is predominantly a sit-and-wait forager, consumes insects (lepidopteran larvae, Orthoptera, Coleoptera, Blattodea, Hymenoptera), spiders and plant material (Ehmann 1983; Hutchinson *et al*. 1994).

The most thoroughly studied species, *T. rugosa*, has a consistent dietary range throughout its distribution. Using a variety of sources of samples (stomach contents, colon contents, scat analysis), and a variety of methods of analysis (frequency of samples containing food types, volumetric analyses, relative mass), the diet consists of plants, with smaller amounts of animal prey. Of animal prey, insects predominate, with the most common insect types being insect larvae, Blattodea, Coleoptera, Hymenoptera and Orthoptera (Bamford 1980; Henle 1989, 1990; Shea 1989; accessory tables accompanying Brown 1991), and occasional molluscs, small vertebrates and carrion (Shea 1989; Dubas and Bull 1991). Despite a similar dietary range, *T. rugosa* appears to differ from other *Tiliqua* in being predominantly herbivorous, with varying methods of analysis concurring that the diet is over 80% plant material (94% volumetrically in stomachs, accessory tables for Brown 1991; 99% volumetrically in scats, Henle 1989, 1990; 99% relative mass in stomachs, Dubas and Bull 1991; 92% weighted average mean of relative dry mass in stomachs from three sampling periods, MacMillen *et al*. 1989; 82% frequency of plants in stomachs, Jones 1992; 90% frequency of plants in colons, Shea 1989).

The lack of any apparent differences in the diet of *Tiliqua multifasciata* and *T. occipitalis* is in agreement with the close phylogenetic relationship between the two species and the dietary range of related species. However, it does not provide any support for the hypothesis that the marked differences between the species in head shape and dentition are adaptations to differing diets. The wider and deeper head, larger temporal area and shorter snout of *Tiliqua multifasciata* (Shea 1992), and the larger, blunter teeth of this species (Shea and Hutchinson 1992), do not appear to coincide with any obvious dietary difference. An adaptive significance for the differences in the trophic apparatus of these two species remains unclear.

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APPENDIX I

Appendix 1 - Dietary contents of *Tiliqua multifasciata* and *Tiliqua occipitalis* stomachs

Tiliqua multifasciata (n = 14)

Kimberley Division:
R14103 (Broome):
Arthropoda:
Coleoptera:
Carabidae: 1 medium beetle (blue edge to black pronotum)
Tenebrionidae: 1 small beetle (5 mm)
Hymenoptera: 1 pupal bee (8 mm) and several wing fragments
Larvae: 9 caterpillars (25 mm) (7 striped with subterminal spine)
≥ 13 smaller hard-bodied larvae (5 mm long)
1 large fragmentary hard-bodied beetle larva
Plants:
1 gilled mushroom (cap 40 mm across)
much plant mulch

R14941 (Derby):
Plants:
pieces of a large fleshy fruit with small (3 mm) ovoid-conical seeds in translucent envelope (11 seeds represented)

R23046 (9 km E Bohemia Downs):
Plants:
ca 30 ovoid-conical seeds (7 mm) with rough brown surface, ridged apex; some fragmented

R23099 (8 km SE Wyndham):
Plants:
1 fleshy berry with small flat yellow seeds (15 mm diameter)
ca 30 small dark hard-shelled seeds (5 mm diameter), fragmented

R27743 (Frazier Downs):
Arthropoda:
Orthoptera: 1 large female cricket (36 mm, including ovipositor)
Coleoptera:
Curculionidae: 1 medium weevil (fragmentary)
Plants:
2 needle-like leaves (accidentally ingested?)

R27746 (Cape Leveque):
Arthropoda:
Coleoptera: 1 beetle (est. 24 mm total) - represented by abdomen and part thorax.
Plants:
2 ovoid, hard-shelled seeds (cracked) (8 mm)
2 pieces of fine plant twig (accidentally ingested?)

R28136 (40 mi ENE Broome):
Vertebrata:
    Squamata: small amounts of shed skin from conspecific

R54178 (8 km N Logues Spring):
Arthropoda:
    Chilopoda: 1 large centipede
    Orthoptera?: 1 segment of limb
Plants:
    1 small hard fruit (5mm diameter)
    3 long grass awns (accidentally ingested?)

R58487 (5 km N Coulomb Point):
Arthropoda:
    Coleoptera:
Scarabaeidae: 1 beetle (20 mm)
        3 small elytra (5 mm)
    Larvae: 1 caterpillar
Vertebrata:
    Aves: several down feather fragments and 3 small partial long bones (5 mm) (?nestling bird)
Plants:
    Several pieces of grass, much indeterminate mulch, some fibrous

R68982 (51 km NE Sandfire Roadhouse):
Arthropoda:
    Orthoptera: 2 grasshoppers (>30 mm)
    Larvae: 3 caterpillars (1 x 40 mm, others smaller or represented only by head capsules and fragmentary bodies)
Vertebrata:
    Aves: 9 small brown bird feathers
Plants: ca. 12 flattened cracked hard coated seeds (7 mm)

R83685 (30 km NE Camballin):
Arthropoda:
    Coleoptera:
Curculionidae: 1 medium-sized black amycterine weevil
    Hymenoptera: 2 small red pupal wasps encased in sand/clay.

R86923 (Lake Argyle):
Arthropoda:
    Larvae: 1 hairy caterpillar (24 mm)
    Orthoptera: 2 grasshoppers (25-30 mm)
    Coleoptera: 1 small beetle (single elytron 5 mm)
Plants:
    1 small dry leaf (?accidentally ingested)
    large amounts of fibrous plant material and segmentally sliced plant stem material (insect gut contents?)

R87185 (Cable Beach, Broome):
Arthropoda:
    Coleoptera: fragments of 1 medium-sized beetle
Vertebrata:
    Squamata: lots of shed skin from conspecific lizard.
Plants:
    20 small hard seeds of several types (<5 mm).

North-West Division:
R12241 (Mardie)
Plants:
    7 large-grained grass seeds

Tiliqua occipitalis **(n = 16)**

South-west Division:

R583 (Perth):
- Arthropoda:
  - Coleoptera:
    - Curculionidae: 1 medium amycterine weevil (10 mm)
    - 1 small brown beetle with punctate elytra (8 mm)
  - Orthoptera: 1 large grasshopper (30 mm)
  - Egg cases: 2 foamy egg cases 24 × 14 mm
- Vertebrata:
  - Mammalia: 1 flat piece of bone, ca 26 × 16 mm (carrion?)
- Plants:
  - 25 small dry leaves
  - 2 small soft leaves
  - 4 pieces small twig

R1123 (Bremer Bay):
- Arthropoda:
  - Orthoptera: 1 large female cricket (30mm)
  - Coleoptera: limbs of small black beetle

R2139 (Greenmount):
- Arthropoda:
  - Blattodea: 1 large roach (iridescent body segments)
  - Coleoptera:
    - Curculionidae: 1 weevil (10 mm)
    - jaws of 2 large beetles
  - Larvae: 1 medium slightly hairy caterpillar (20 mm)
  - much small highly comminuted insect material.
- Vertebrata:
  - Aves: 5 small contour feathers
- Plants:
  - *ca* 15 small flat yellow seeds

R5051 (Victoria Park, Perth):
- Arthropoda:
  - Blattodea: 1 cockroach
  - Coleoptera:
    - Curculionidae: 1 medium-sized black weevil
  - Tenebrionidae: 1 piedish beetle
- Plants:
  - 7 small fleshy fruits (7 mm diameter), pink-brown with hard central seed

R16542 (Mukinbudin):
- Arthropoda:
  - Chilopoda: 1 small centipede (25 mm)
  - Araneida: limbs of 2(?) medium huntsman-type spiders
  - Coleoptera: elytra of small beetle (7 mm)
  - Orthoptera: limbs of medium sized grasshopper
  - Larvae: ≥ 10 insect larvae with large head capsules (sawflies?)
- Plants: 2 small flowers

R16543 (Wyalkatchem):
- Arthropoda:
  - Coleoptera:
    - Curculionidae: 1 large *Leptopius* sp.
    - fragments of a smaller brown beetle
  - Larvae:
    - ≥ 9 moderate to large caterpillars (≤ 25 mm), represented by head capsules and body fragments
- Vertebrata:
  - Mammalia: small amount of fur (carrion?)

R16925 (Balline):
Arthropoda:
    Coleoptera:
        Curculionidae: 1 *Leptopius* sp. (20 mm)
Plants:
    226 small rounded berries (5mm) with central hard seed
    5 small leaves with acuminate tip (5 mm) (accidentally ingested?)
    5 segments of small dry stick (accidentally or secondarily ingested?)

R19849 (Dongara):
Arthropoda:
    Araneida: 1 small long-limbed spider
    Diplopoda: 1 small millipede
    Coleoptera: Tenebrionidae: 1 small beetle (5 mm) (associated with ingested fungi?)
    Hymenoptera: 1 small pupal bee
    Larvae: 2 small maggot-type larvae (associated with ingested fungi?)
Vertebrata:
    Squamata: Agamidae: dry pes of small *Rankinia adelaidensis* (carrion?)
Plants:
    ca 40 small flowers (some whole, some comminuted, with separate fleshy immature seeds and/or ovaries)
    ca 6 small gilled mushrooms (caps 1cm diameter) - comminuted

R22532 (3 mi E Nornalup):
Arthropoda:
    Blattodea:
        1 medium-sized (abdomen 15 mm wide) burrowing roach
    Coleoptera:
        Curculionidae: 1 weevil (15 mm)
        Tenebrionidae: 5 piedish beetles (14 mm)
        elytra of 2 small brown beetles (8, 10 mm)
    Larvae: one large burrowing larva (50 mm)
Plants:
    ca 15 large ovate/cylindrical seed pods 21 x 7 mm, containing large numbers of small black seeds (and large numbers of loose seeds of the same type)
    2 pieces of dry sclerophyllous leaf (accidentally ingested?)

R22879 (Caron):
Vertebrata:
    Mammalia: 1 small piece of cortical bone from large mammal (carrion?)
Plants:
    18 small chenopod leaves/growing tips

R24092 (Scarborough, Perth):
Arthropoda:
    Orthoptera: 1 large burrowing cricket (55 mm)
Mollusca:
    Gastropoda: 2 snail bodies

R97464 (18 km S Kodj Kodjin):
Arthropoda:
    Araneida: 1 medium hairy spider (25 mm diameter)

North-West Division:
R16541 (5 mi N Mouroubra):
Arthropoda:
    Scorpionida: 1 *Urodacus* scorpion claw
    Coleoptera:
        Curculionidae: 1 medium-sized *Leptopius* sp.
    Larvae: 1 large hairy caterpillar (30 mm), ≥ 2 other caterpillars (30 mm)
Plants:
    1 long strand grass (accidentally ingested?)

R22759 (Denham):

Arthropoda:

Larvae: 6 hairy caterpillars (≤25 mm)
1 non-hairy caterpillar (27 mm)

Unidentified: abdominal segments and wings of a medium-sized insect(s)

South Australia:

R27360 (Port Lincoln)

Plants:

23 fruits (8 mm x 6 mm), sepals in a cone, bearing at tip an ovoid fruit containing a central hard/rough coated seed with limited fibrous pulp around it; fruit bears a thin black pistil at tip; seed 5.5 x 4 mm.

Northern Territory:

R21491 ("Tennant Creek area" - in error):

Arthropoda:

Coleoptera:

Curculionidae: 1 medium black weevil (*Molochtus*-like) (18 mm)
Scarabaeidae: 1 dung beetle (accidentally ingested with dung?)

Plants:

Dung from an herbivorous mammal